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MONTHLY WEIGHT AND BALANCE FEPORT

FOR THE APOLIO SPACECHAFT

CONTRACT NAS 9-150

(U)

1 DECEMBER 1963



PARAGRAPH 5.1 , EXHIBIT I

Prepared by

Weight Control

CLASSIFICATION CHANGE

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NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION



ORM M158-D-3 VELLIM REV. 2-61



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INTRODUCTION

The December report reflects a change in the reporting format to include the current Airframe Oll drawing release as a basis. The current weight status section summarizes the changes from the previous LOR status to the current Airframe Oll weight, and incorporates the estimated changes for the LOR mission spacecraft. A section has been added describing the LOR estimated changes. The new format will allow weight status reporting consistent with Airframe Drawing Release and continuous updating of the estimated LOR changes.

This report reflects a spacecraft weight increase of 740 pounds at injection and 310 pounds at the injected spacecraft condition less Service Module propellant. The current injected weight of 85,315 pounds is based on a Service Module loaded with sufficient propellant at a specific impluse of 313.0 to provide 10 per cent $\triangle V$ margin. This is based on a LEM weight including crew, of 25,000 pounds.

The major changes in the Command Module were due to the incorporation of the current Airframe Oll changes, the addition of LEM docking provisions, and the incorporation of Category I weight reductions from the current weight reduction program.

The major changes in the Service Module were due to the incorporation of the current Airframe Oll changes and the addition of rendezvous radar equipment.

The major changes in the Launch Escape System were due to the addition of the boost protection cover and a decrease in ballast consistent with the combined Launch Escape System and Command Module balance requirements.

The Earth Orbital Mission Weight Summary reflects a two stage Booster-to-Orbit injection without the use of Service Module propulsion and is based on a complete Service Module loaded with 2425 pounds of de-boost propellant. The earth orbit weight reported limits the orbital altitude capability with the Saturn I booster to 80.0 nautical miles. To obtain the 100 nautical orbital altitude with the Saturn I booster requires off loading the Command Module and Service Module.



APOLLO LOR MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUPPARY

	WEIGHT	CINTER	OF	GRAVITY*	MOMENTS C	OF INERTIA (SLUG-FT.2)	JUG-FT.2)
ITEM	POUNDS	×	Ā	Z	ROLL (X)	рттсн (х)	YAW (Z)
COMMAND MODULE	9770	1044.0	-0.2	7.3	7777	4055	3808
SERVICE MODULE - Less Propellant	0966	908.2	0.2	-0.1	9269	10670	10486
TOTAL - Less Propellant	19730	475.4	0.0	3.6	10890	34415	33927
PROPELLANT - S/M**	37725	6.906	5.3	-2.2	19424	20056	26687
TOTAL - With Propellant	57455	930.0	3.5	-0.2	30485	67933	1907/
LUMAR EXCURSION MODULE	094742	623.0	0.0	0.0	13616	12776	13247
ADAPTER - LEM - C-5	34,00	642.7	0.0	0.0	8372	12273	12273
TOTAL - Injected	85315	830.6	2.3	0.3	52533	520697	475716
LAUNCH ESCAPE SYSTEM	7215	1294.0	0.0	-0.2	283	12390	12392
TOTAL - SPACECRAFT LAUNCH	92530	366.7	2.1	0.2	52824	789854	796504

*Centers of gravity are in the MASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold NOTES:

determined from an estimated time line analysis. The propellant weight is based on a specific impulse of 313.0. **The propellant weight of 37725 pounds provides approximately $10\%\,\triangle$ V margin, and is

APOLLO FARTH ORBIT MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

SCHULL	WEIGHT	CENT	CENTER OF GRAVITY*	AVITY*	MOMENTS OF	NERTIA (SLUG-FT.2)	.ug-ft.2)
WET T	POUNDS	×	>	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	0246	1044.0	-0.2	7.3	7777	7:05	3808
SERVICE MODULE - Less Propellant	0966	908.2	0.2	-0.1	6370	10670	10486
TOTAL - Less Propellant	19730	4.576	0.0	3.6	10890	34415	33927
PROPELLANT - S/M**	2425	0.673	27.3	-11.5	815	777	795
TOTAL - With Propellant	22155	9,196	3.0	1.9	12158	42417	75290
ADAPTER - C-1	830	7.677	0.0	0.0	1029	753	753
TOTAL - Injected	22985	955.0	2.9	₩ 	13189	78885	78759
LAUNCH ESCAPE SYSTEM	7215	1294.C	0.0	-0.2	283	12390	12392
TOTAL - Spacecraft Launch	30200	1036.0	2.2	1.4	13486	197461	197341
	A SA ESPANIST AND THE PROPERTY AND THE CONTRACT		Section Inc. vol. 800/800-10/10/10/00	Manager of the state of the sta			

*Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line. NOTES:

**The earth orbital weights are based on a complete service module and includes 24.25 pounds of propellant for an orbital altitude of about 80.0 nautical miles with a payload launch azimuth of 72° .



APOLLO LAUNCH ABORT CONFIGURATION

WEIGHT, CENTER OF GRAVITY AND INTERTIA SUMMARY

VIII I	WEIGHT	CENTER	CENTER OF GRAVITY*	/ITY*	O SLNENOM	moments of inertia (slug-ft. ²)	UG-FT. ²)
LIM.	Pounds	×	⊁	2	(x) TIOE	PITCH (Y) YAW (Z)	YAW (Z)
COMMAND MODULE	0246	1044.0 -0.2	-0.2	7.3	7777	4055	3608
LAUNCH ESCAPE SYSTEM	7215	1294.0 0.0	0.0	-0.2	283	12390	12392
TCTAL - Launch Abort	16985	1150.2 -0.1	-0.1	4.1	76627	72462	72186
LESS - MAIN AND PITCH MOTOR PROPELLANTS	-3210	1296.5 0.0	0.0	0.0	69-	-1330	-1330
TOTAL - LES Burmout	13775	1116.1 -0.1	-0.1	5.1	4711	52851	52570

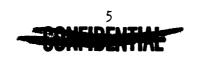
*Centers of gravity are in the MASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module mold line. NOTE:

COMMIND NODULE

THIGHT, CENTER OF GRAVITY AND INFRITA SUPPORT

LUMAR ORBIT RENDEZVOUS MISSION

	TIGHT	CENTER	OF	GRAVITY		SS IN	MASS INERTIA DATA (SLUG-FT.2)	TA (SLU	G-FT.2)	
VSHICLE: NODE.	Pourids	X	> -1	5-3	X.	Iyy	Izz	Lxy	Įx?	IZ
COPEAND MODULE, LAUNCH	0779	1044.0	-0.2	7.3	7777	4055	3808	4	-222	-25
ADJUSTMENTS (NET) Boost & Mission Coolants Food & Later Consumption Mission Waste Pickup Fuel Cell Mater Pickup Docking Provisions	-23									
PRIOR TO ENTRY	2726	1042.9	0.2	7.5	4513	7007	3751	19	-232	-16
Less: Propellant Ablator Burnoff Entry Coolant Forward Heat Shield Drogue Chutes	-270 -223 -536 -336 -50	1022.6 1019.7 1022.6 1095.3 1090.0	63.4 0.0 0.0 0.0	56.6 11.2 16.4 3.4 22.0						
PRIOR TO MAIN CHUTE DEPLOYATIVE	8862	1041.7	0.0	6.2	6207	3390	3241	11	-142	-17
Less: Main Chutes (3)	-461	1089.9	0.3	6.7						
LANDING	1073	1039.1	0.0	6.2	4025	3128	2959	10	-11:4	-17



COMMAND MODULE + LEV

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

HIGH ALTITUDE ABORT CONDITION

		2000	and the state of t	STATE OF THE PARTY	** * * * * * * * * * * * * * * * * * *		Comprised the company of the company			-
	WEIGHT	CENTER	OF GRAVITY	ITY	MAS	S INERT	MASS INERTIA DATA	(SI,UG-FT. ²)	T.2)	
VEHICLE MODE	POUNDS	×	Y	2	Ixx	Iyy	Izz	Ixv	Ixz	Iyz
COMMAND NODULE LAUNCH	9770	1077	-0.2	7.3	7977	4055	303€	7	-222	-25
Boost Cover LEV Tower	175	1100.7 114.6	0.0	0.0						
C/K, TOWER & COVER	10555	1050.8	-0.2	9.9	9657	5658	5399	6	-369	-24
Less: Boost Coolant Tower Insulation B/O	-701-	1022.6	-63.4	-16.4					Age 1 - 1 spec - 2 mil 1 -	
c/k, abort phase	10447	1049.9	-0.2	6.7	4575	5433	1713	5	-356	-25
Less: Propellant Entry Coolant LEV Tower Boost Cover Forward Heat Shield Docking Provisions Drogue Chutes	-270 -6 -506 -175 -100 -50	1022.6 1022.6 1145.1 1100.7 1098.3 1110.0	63.4	56.6 -16.4 -3.1 0.0 0.0 -22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	7006	1041.7	0.0	6.2	4167	3491	3337	-5	-138	-26
Less: Main Chutes (3)	-461	1089.9	0.3	6.7						
LANDING	8543	1039.1	0.0	6.2	6117	3228	3054	Ŷ	-140	-26

NOTE: Mass inertia data is shown for accumulative totals only.

UNITEDATION

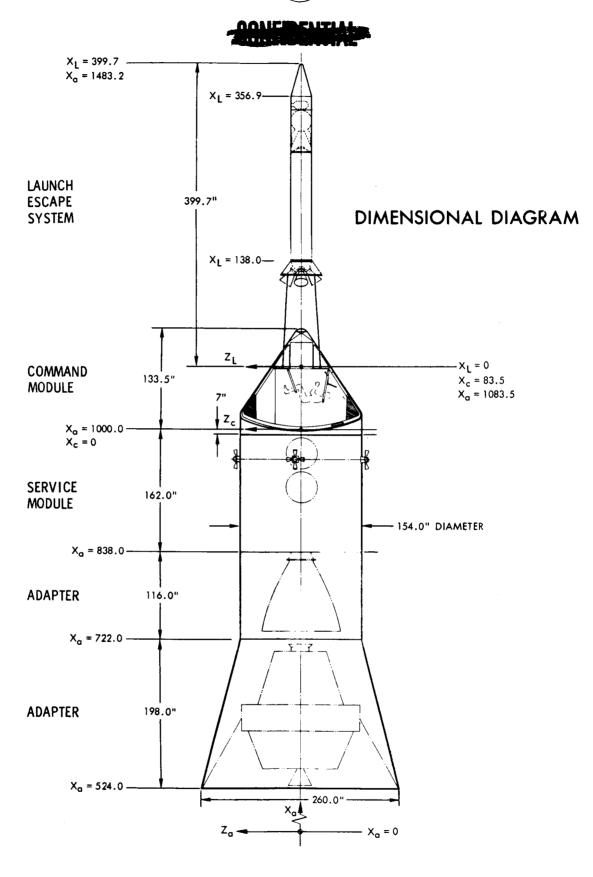
COLUMN MODULE

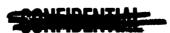
TEIGHT, CTUTION OF GRAVITY AND INERTIA SUPPLANT

LOW ALTITUDE APORT CONDITION

	THOIT	CENT	CENTIFE OF GRAVITY	λ. I.Λ	22	MASS INF	TI. DAS	INTRIL DATA (SLUG-Fr. ²)	-Fr.2)	
VURICET MODE	POUNDS	X	Ą		ĻX	Lyy	Izz	Ľ	Ixz	Izy
COMMAND MODULE, LAUWCH	0779	1044.1	-0.2	7.3	7770	4055	3808	7	-222	-25
Less: Propellant Forward Heat Shield Docking Provisions Drogue Chute	-270 -336 -100 -50	1022.5 1098.3 1110.0 1090.0	0.00	56.6 3.4 0.0 22.0						
PRICR TO MAIN CHUTE DEPLOYMENT	9014	1041.6	-0-1	6.2	4774	3484	3337 -2	7	-125 -24	-24
Less: Kain Chutes (3)	-461	1089.9	0.3	6.7						
LANDING	8553	1039.0	-0.1	6.2	4127	3220	3053	7-	-128	-24

NOTE: Mass inertia data is shown for accumulative totals only.







TOWN DOLLARS

SPACECRAFT

WEIGHT STATUS SUMMARY

(LESS LEM)

ITEM	PREVIOUS LOR STATUS	CHANGE TO CURRENT	CURRENT AFRM Oll WEIGHT	ESTIMATED CHANGES TO	CURRENT LOR WEIGHT	BASIS LOR	FOR CU STATU	
11121	11-1-63	AFRM	12-1-63	LOR	12-1-63	%EST	%CAL	%ACT
COMMAND MODULE	9730	+190	9920	-150	9770	51	47	2
SERVICE MODULE - B/O	9690	+60	9750	+210	9960	21	72	7
LES	7050	+50	7100	+115	7215	39	51	10
ADAPTER	3400	-2570	830	+2570	3400	100		
TOTAL LESS PROPELLANT	29870	-2270	27600	+2745	30345	44	51	5
LOR PROPELLANT	-	-	-	-	37725		100	
GROSS WEIGHT	_	_	_	<u>-</u>	68070	19	. 79	. 2

INJECTED SPACECRAFT

MEIGHT STATUS

ITEM	PREVIOUS LOR STATUS 11-1-63	CHAMGE TO CURRENT	CURRENT LOR STATUS 12-1-63
CCMMAND MODULE	9730	+40	9770
SERVICE MODULE	9690	+270	9960
ADAPTER	3400		3400
LPM	24460		24460
TOTAL S/C Injected Less Propellant	47280	+310	47590
PROPELLANT	37295	+430	37725
TOTAL INJECTED WEIGHT	84575	+740	85315

DOM DENTINE

COMMAND MODULE WEIGHT STATUS



COMMAND MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

STRUCTURE	(+177.0)
Increase basic body structure forward section to protect the forward pitch motor installation from the parachute harness during Command Module tumbling at parachute deployment. The motor installation must be protected so that the RCS system is intact during propellant burning (dumping) as the Command Module decends on the main parachutes. The structural additions are as follows:	+27.0
Increase in existing pitch motor support beams due to an increase in riser impact to 50,000 pounds. +7.0 Addition of fitting on the forward bulkhead to	
transfer riser impact loads into primary structure. +8.0 Increase of inner structure to provide support and attachment structure for riser impact	
fittings. +12.0	
Increase inner structure to heat shield shear attachment at Station 42 due to calculations based on released drawing in lieu of estimates.	+6.0
Increase secondary structure due to the following changes:	- 44.0
Addition of structure to the right hand equipment bay for inflight storage of the CO ₂ absorbers to allow sufficient clearance for storage of the center crew couch. +5.0	
Increase in right hand equipment bay due to calculated weight of compartments for personal hygiene supplies in lieu of estimated. 45.0 Increase in left hand equipment bay due to a change from 3 - 10 honeycomb core to 2 - 60 (reinforced)	
honeycomb core in the side shock attenuation panel for couch impact loads. +3.0 Increase forward right hand equipment bay due to calculation of the survival kit retaining door and support replacing an estimated weight for a	
simple closure. +6.0	

+260.0



PONFIDENTIAL

COMMAND MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

STRUCTURE (Continued)

Increase in lower equipment bay due to the addition of aluminum filler blocks (approximately 30) placed within the honeycomb panels as a solution to the coldplate attachment to structure problem. Increase in lower equipment bay due to the addition of structure resulting from the relocation of equipment for center of gravity improvement.	+13.0	
Increase heat shield substructure due to the following cha	nges:	+61.0
Increase in forward heat shield nose cone due to an increase in skin thickness which will not	+5.0	
be chem-milled on the early vehicles. Addition of structure due to an increase in the number of inner to outer attach stringers per	±7.0	
current drawing release. Increase in rendezvous window well structure due to using a casting design in lieu of an estimated	+11.0	
honeycomb design. Addition of a moment tie to the aft heat shield at the toroidal section for structural integrity	+12.0	
required during cold soak conditions. Increase in center section heat shield due to an increase in honeycomb panel face sheets which	-£.0	
will not be chem-milled on the early vehicles.	+25.0	
Increase ablator due to more detailed heating information toroidal section and incorporation of Avco's estimate of the page of	$\circ f$	
ablator required to cover the nose cap replacement of t radome.	Me	+39.0
INSTRUMENTATION		(+305.0)

Add R & D instrumentation consistent with current measurement lists for flight qualification requirements.

Install PAM/FY/FM telemetry syste	em, three commutators and one	
tape recorder to handle flight	qualification PCM requirements.	+45.0

CONTROCTS	A BITO	DTCDTAVC	(+6.0)
CONTROLS	AND	DISPLAYS	(0.0÷)

Increase controls and	displays	based	on	calculations	of	current	
released drawings.	1 6						+6.0





COMMAND MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

STABILIZATION AND CONTROLS	(-7.0)
Decrease ECA packages based on Honeywell data reducing the clamps that hold the coring cards and reflecting actual weights.	-7.0
REACTION CONTROL SYSTEM	(+4.0)
Increase engine weight consistent with current procurement specification weight.	+3.6
Increase dumping system due to miscellaneous calculated weights.	+ .4
ELECTRICAL POWER	(+11.0)
Increase inverters due to incorporating current Westinghouse status.	+6.0
<pre>Increase A-C power box assembly based on calculations of current released drawings.</pre>	+0.8
Increase circuit breaker panel due to the addition of wiring and terminals required to wire up the panel.	+O•14
Add wiring and controls for Service Module located sequencer for operating Service Module RCS engine after Command Module - Service Module separation. The system is required to provide sufficient distance and \triangle V between the Command Module and Service Module during entry.	÷3.0
Increase umbilical feedthru plate due to changing material from aluminum to steel per the requirements that outer heat shield components must be made of steel.	+2.0
Decrease umbilical feedthru insulation due to removal of ablative plug weight which is carried in the Avco weights.	-1.2



COMMAND MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

ENVIRONMENTAL CONTROL	(-6.0)
Increase water-glycol circuit subcontractor weights based on AiResearch status reflecting the following:	+0.9
Deletion of (3) glycol shutoff valves0.6 Addition of (3) solenoid shutoff valves due to	
simplification of ECS water management and coolant systems. +3.0	
Deletion of glycol accumulator manual override control for weight reduction purpose1.5	
Decrease water supply system subcontractor weight due to the deletion of the Freon storage tank for simplification of the ECS water management and coolant systems.	-3.3
Increase water supply system due to the addition of a warning system to provide a warning display to indicate malfunction in the ECS water separator accumulator units. This system is required because loss of water and oxygen in the event internal leakage of the accumulator occurs; this could result in mission abort.	÷2.0
Decrease waste management system due to a change in plumbing and fitting material from steel to aluminum and incorporation of miscellaneous vendor weights.	-5.6
EARTH LANDING SYSTEM	(-10.0)
Decrease drogue chute system based on Northrop status reflecting actual weights of test parts versus calculated weights.	-1.6
Decrease main cluster based on Northrop status reflecting the following:	-12.5
Re-evaluation of main chute package utilizing actual weights of test items8.4 Change in clevis fitting2.6 Recalculation of protectors and padding requirements1.5	
Decrease pilot chute system pack assembly based on Northrop status reflecting recalculation of attaching parts.	-0.4



CONFIDENCE

COMMAND MODULE

CURRENT AIRFRANE WEIGHT EMPTY CHANGES

EARTH LANDING SYSTEM (Continued)

Increase sequence control assembly based on Northrop status reflecting repackaging of redundant control into two separate packages.	+1.0
Increase attach provisions due to calculation of released drawings of the drogue chute riser attach fitting.	+1.0
Increase forward heat shield release system based on an increase in the tubing wall thickness due to increased pressures.	+2.5

TOTAL COMMAND MODULE CURRENT AIRFRAME WEIGHT EMPTY CHANGES

+480.0



COMMAND MODULE

CURRENT AIRFRAME USEFUL LOAD CHANGES

CREW SYSTEMS	(-30.0)
Decrease weight of radiation dosimeters per NASA TWX.	-3.0
Delete Lunar boots from pressure garment assembly as the current definition of the suit is that it is inter-vehicular.	-10.8
Decrease clinical monitoring instrument set per current specification requirements.	-3.0
Delete personal hygiene deodorant pads as the constant wear garments have deodorant provisions.	-2.7
Decrease sunglasses based on revised estimates.	-0.5
Decrease food and containers based on latest vendor weights.	-10.0
ENVIRONMENTAL CONTROL	(-10.0)
Delete freon due to simplification of the ECS water management and coolant system which add a heat sink in the glycol circuit.	-10.0
SCIENTIFIC EQUIPMENT	(-250.0)
Delete scientific equipment based on current requirements.	- 250.0
TOTAL COMMAND MODULE CURRENT USEFUL LOAD CHANGES	-290.0

SERVICE MODULE WEIGHT STATUS

	PREVIOUS	CHANGE	CURRENT	ESTIMATED CHANGES	CURRENT	BASIS	BASIS FOR CURRENT LOR STATUS	RRENT IS
METI	STATUS 11-1-63	CURRENT	MEIGHT 12-1-63	TO	WEIGHT 12-1-63	& EST	% CAL	% ACT
Structure	2210	07+	2250	07+	2290	П	7/4	15
Electronics	177	77+	181	170	351	700		
Reaction Control	580	•	580		580	61	39	
Electrical Power	1363	+21	1384	_	1384	13	09	2.7
Environmental Control	92	5	87		87	19	77	77
Propulsion System Engine Installation Propulsion System	(3038) 715 2323		(3038) 715 2323		(3038) 715 2323	13	18	
WEIGHT EMPTY	097/	09+	7520	+210	7730	27	79	6
RCS Propellant	838		838		838	Landeld . Mrs	100	
Electrical Power Super. Fluids	503		503		503		100	
Environmental Contr. Super. Fluids	208		208		208	www.	100	
Main Propulsion Helium	66		66		66	,	100	
Main Propellant Residuals Trapped - System Trapped - Engine Mixture Ratio Tolerance Loading Tolerance	(582) 225 67 100 190		(582) 225 67 100 190		(582) 225 67 100 190		100	
BUINOUT WEIGHT	0696	09+	9750	4210	0966	7.7	2	C
Main Propellant LOR	ł		1	,	37725		100	:
GROSS WEIGHT	-	transport de l'agrant contra de la contra del la contra de la contra de la contra del la contra de la contra de la contra del la contr			1,7685	7	95	
			a de la companya de l					

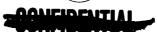


SERVICE MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

STRUCTURE	(+40.0)
Increase the insulation weight in the area of the aft heat shield due to the following:	+40.0
Increase in density of the Q-felt insulation from 3.5 lbs./cu.ft. to 6.0 lbs./cu.ft. per current released drawings based on thermo information. +11.0	
Increase in density of the NRC-2 insulation from 3.5 lbs./cu. ft. to 4.7 lbs./cu. ft. per released drawings based on latest thermo	
information. +2.0 Increase in insulation supports due to calculations of current drawing reflecting a change from attaching directly to the bulkhead to attaching	
to brackets away from the bulkhead leaving a +8.0	
Increase in Q-felt insulation area due to current engine heat requirements. +19.0	
ELECTRONICS	(4.0)
Increase antenna coax based on calculation of current cable lengths.	+4.0
ELECTRICAL POWER	(+21.0)
Increase fuel cell power pack due to a change in core structure of the fuel cell coolant regenerator in order to improve the flow distribution.	+0.6
Increase supercritical gas storage system H2 tank due to a reduction of the allowable stress of the titanium pressure vessel from 105 ksi at burst and 95 ksi at proof to 50 ksi at limit pressure.	+15.4
Increase H_2 component mounting provisions based on revised calculations.	1.5-
Increase 02 tank support shelf and component mounting provisions due to the addition of fittingsper current stress requirements.	-4.6





SERVICE MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

ELECTRICAL POWER (Continued)

Increase radiator skin thickness in the flow areas based on current drawings.	+2.2
Decrease common utility provisions based on revision of current requirements.	-3.3
ENVIRONMENTAL CONTROL SYSTEM	(-5.0)
Increase water-glycol subcontractor components due to simplification of the water management and coolant systems.	÷4.0
Decrease water-glycol plumbing and hardware based on calculation of released drawings reflecting fewer fittings.	6
Delete water supply system valves due to simplification of system.	1
Decrease common items supports and hardware based on calculations of current requirements.	-4.7
TOTAL SERVICE MODULE CURRENT AIRFRAME WEIGHT EMPTY CHANGES	÷60.0



LAUNCH ESCAPE SYSTEM

WEIGHT STATUS

ITEM	PREVIOUS LOR STATUS	CHANGE TO CURRENT	AFRM 011	ESTIMATED CHANGE	CURRENT LOR	LO	R STATI	JS
	11-1-63	AFRM	12-1-63	TC LCR	WEIGHT 12-1-63	% EST	€ CAL	% ACT
Structure	1062	· +3	1065		1065	9	75	16
Electrical System	58	• • • • • • • • • • • • • • • • • • •	58	!	58	100	!	
Propulsion System Main Thrust Jettison Jettison Motor	4764 434	:	1,764 431 ₄		4764 43L	40	60	100
Skirt Pitch Control	92 55		92 55		92 55	60	40	100
Separation Provisions	67		67		67	6 1	3 9	
C/M Boost Prot. Cover		:		+175	+175	100		
LES - NO BALLAST	6532	+3	6535	+175	6710	35	55	10
BALLAST	518	+47	565	-60	505	100		
TOTAL L.E.S.	7050	+50	7100	+115	7215	39	51	10



TOMPOSITIAL

LAUNCH ESCAPE SYSTEM

CURPENT AIRFRAME WEIGHT CHANGES

STPUCTURE	(- -3)
Decrease tower assembly due to calculations of the tower structure based on current released drawings.	-3
Increase pitch motor support structure due changing to Inconel-X material to avoid weld cracking.	+7
Decrease attaching parts due to current drawing calculations.	-1
BALLAST	(+47)
Increase ballast consistent with current Command Module and LES balance requirements.	+47
TOTAL LAUNCH ESCAPE SYSTEM CURRENT AIRFRAME WEIGHT CHANGES	+50
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WEIGHT STATUS

ITEM:	PPEVIOUS LOR STATUS 11-1-63	CHANGE TO CUPRENT AFRM		TSTIMATED CHANGE TO LOR	LOR	FASIS FOR CU LOR STATU	S
Structure	3070	- 2 3 55	715	-2 3 55	3070		
Electrical	0.3	- 60	20	+60	60		
Separation System	250	-155	95	-155	250		
TOTAL ADAPTER	3400	-2570	£30	-2570	3400	100	





ADAPTER

CURRENT AIRFRAME MEIGHT CHANGES

Utilize the S IV Adapter consistent with the current Airframe Oll mission requirements in lieu of the S IV B LFM Adapter.

-2570



COMMAND MODULE

CURRENT LOR WEIGHT EMPTY CHANGES

STRUCTURE	(- 66)
Eliminate the heat shield substructure face sheet pads (scar weight) provided on the first few spacecrafts for designs that were not consummated (strakes, plugs, vents, etcs.).	- 26
Analyze structure design in detail based on a refinement of loading conditions, as the original design was accomplished on an extremely tight schedule utilizing a minimum of loads and equipment information.	-14C
Incorporate a boost protection cover over the Command Module nose to be jettisoned with the Launch Escape System tower. This would allow the ablative material thickness on the nose to be reduced.	- 30
Reduce the spacecraft temperature criteria from 250°F to 200°F. A saving of approximately one pound of ablative material can be removed for every degree reduction at start of entry.	-50
Refine secondary structure design by additional machining of extrusions utilized in coldplate closeouts, alternate materials, and a reduction of supports for scientific equipment	60
Reduce heat shield window glass thickness from 0.70 inch to 0.55 inch based on a more detailed thermal and structural analysis.	-10
Add LEM docking provisions for the LOR mission.	+150
COMMUNICATIONS	(-9)
Delete console interface connectors resulting in some complications in manufacturing and repair of console.	- 9
INSTRUMENTATION	(- 305)
Delete instrumentation required for flight qualification.	- 305



COMMAND MODULE

CURRENT LOR WEIGHT EMPTY CHANGES

CONTROLS AND DISPLAYS	(+3)
Reduce weight of displays by utilizing lamps in lieu of the barometric pressure indicator and by sharing cryogenic pressure and quantity readouts between the hydrogen and oxygen requirements.	-4
Delete the self-test capability of the SCS displays.	- 2
Delete tail-off switch from delta V indicator.	-1
Delete present reaction jet solenoid power switching relays from the SCS mode select panel. Utilize a manual switch and circuit breakers for reaction jet solenoid power control.	- 2
Replace roll attitude error needle servo drive with galvanometer movement.	-1
Add rendezvous radar panel required for LCE mission.	+13
STABILIZATION AND CONTROL	(-10)
Remove all elapsed time indicators prior to flight.	-1
Utilize partial potting in low dissipation ECA modules.	- 5
Reduce total length of ECA package. Packages are presently designed to include growth capabilities.	- 3
Delete multiple monitor relays in DC amplifiers.	- 1
ENVIRONMENTAL CONTROL	(-4)
Utilize a combined tank with separate compartments for waste water and potable water.	-4
TOTAL COMMAND MODULE CURRENT LOR WEIGHT EMPTY CHANGES	-391





COMMAND MODULE

CURRENT LOR USEFUL LOAD CHANGES

CREW SYSTEMS	(-9)
Reduce life rafts due to design refinement utilizing higher strength to weight ratio materials.	- 9
SCIENTIFIC EQUIPMENT	(+250)
Add scientific equipment based on current LOR mission requirements.	÷2 5 0
TOTAL COMMAND MODULE CURRENT LOR USEFUL LOAD CHANGES	+241



SERVICE MODULE

CURRENT LOR WEIGHT EMPTY CHANGES

STRUCTURE	(+40)
Add structural beef-up required to support the rendezvous radar equipment.	+40
ELECTRONICS	(+170)
Add rendezvous radar equipment consistent with the LOR requirements.	+170
TOTAL SERVICE MODULE CURRENT LOR WEIGHT EMPTY CHANGES	+210



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LAUNCH ESCAPE SYSTEM

CURRENT LOR WEIGHT CHANGES

TRUCTURE	(+175)
Add a boost heat shield for protection of the forward compartment during boost heating. The addition of the boost heat shield reduces the forward compartment heat shield ablative thickness and lightens the injected spacecraft weight.	+175
MALLAST	(-60)
Decrease ballast consistent with current Command Module LES balance requirements.	-60
COMMIT TAXABLE DISCOURS CARREST CARREST TOD LITERALITY CHANGES	+115
OTAL LAIMOU ESCADE SYSTEM CHERENT LOP WETCHT CHANGES	+1



ADAPTER

CURRENT LOR MEIGHT CHANGES

Utilize the S IV B Adapter consistent with the current LOR mission requirements in lieu of the S IV Airframe Oll adapter.

+2570



POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

CREW SYSTEMS	(-137)
Change in crew and metabolic criteria based on astronaut data and new NASA metabolic rates.	
Crew Food and Containers	-49 -12
Delete requirement for the PISS as there is no extra vehicular missions planned from the Command Module.	-45
Decrease mission duration from 14 days to 8 days:	
Food and Containers Chemical Disinfectant	-26 -5
COMMUNICATION & INSTRUMENTATION	(-44)
Repackage PCM components.	-18
Utilize Conic Corporation VHF/FM and unmodular HF.	- 8
Delete PCM provision for flight qualification instrumentation growth.	- 10
Utilize Rantec multiplexer.	- 8
STABILIZATION & CONTROL	(-34)
Utilize magnesium in lieu of aluminum on ECA base plates.	-25
Change internal package connectors from Amphenol to Cannon based on recent connector optimization study.	- 9
ELECTRICAL POWER SYSTEM	(+221)
Increase wiring per current preliminary wire evaluation.	+175
Increase electrical Command Module to Service Module umbilical consistent with potential intermodular wiring requirement.	+60
Decrease inverters due to redesign of power transisters.	-14



POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

ENVIRONMENTAL CONTROL SYSTEM	(-70)
Reduce lithium hydroxide and containers per change in Crew and Metabolic criteria based on astronaut data and new NASA metabolic rates.	-18
Reduce quantity requirements of lithium hydroxide due to mission duration decrease from 14 days to 8 days.	-47
Add re-entry oxygen required due to deletion of PISS.	+4
Delete two lithium hydroxide charges by raising the maximum allowable ${\rm CO}_2$ content.	-9
SCIENTIFIC EQUIPMENT	(-170)
Remove from Lower Equipment Bay	- 35
Remove from Right Hand Equipment Bay.	-135
TOTAL POTENTIAL CHANGES, COMMAND MODULE	-234



POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

SERVICE MODULE

ELECTRICAL POWER	(-84)
Reduce H_2 for 8 day mission in lieu of 14 day.	-12
Reduce C2 for 8 day mission in lieu of 14 day.	- 280
Decrease in Fuel Cell Power System based on folded fuel cell design.	-50
Increase fuel cell reactants for 660 kw-hrs.	+58
Increase electrical Command Module to Service Module umbilical consistent with potential intermodular wiring equipment.	÷ 5 0
Increase wiring per current preliminary wire evaluation.	+150
ENVIRONMENTAL CONTROL	(+70)
Addition of propellant heating system to maintain fuel at temperatures above freezing point.	+70
TOTAL POTENTIAL WEIGHT CHANGES - SERVICE MODULE	-11,



CONTIDENTIAL TO

DETAIL WEIGHT STATEMENT

COMMAND MODULE

SUMMARY

ITEM		CURRENT WEIGHT 12-1-63
WEIGHT EMPTY		8224
Structure	4672	
Crew Systems	298	
Communications	383	
Instrumentation	175	
Controls & Displays	291	
Guidance & Navigation	420	
Stabilization & Control	203	
Reaction Control	327	
Electrical Power	4,99	
Environmental Control	29 3	
Earth Landing	663	
USEFUL LOAD		1546
Crew Systems	869	
Reaction Control	270	
Environmental Control	157	
Scientific Payload	250	4
GROSS WEIGHT		9770

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DETAIL WEIGHT STATEMENT		
COMMAND MODULE		CURRENT
ITEM STRUCTURE		WEIGHT
STRUCTURE		12-1-63
Basic Body Structure		(20/2)
Forward Section		(1061)
	10	207
Honeycomb	63	
Frames, Rings and Hatches Fittings and Attachments	57	
Center Section	87	//-
Honeycomb Panels	304	665
Longerons, Frames and Rings	196	
Window and Hatches	263	
Fittings and Attachments	104 102	
Aft Section	102	1.00
Honeycomb Panel	110	189
Ring	79	
Secondary Structure	77	(556)
RH Equipment Bay and Coldplates		(550) 80
LH Equipment Bay		03 03
Fwd. LH Equipment Bay		20
Fwd. RH Equipment Bay and Coldplates		20 19
Main Display Panel and Coldplates		19 59
Lower Equipment Bay and Coldplates		195
Aft Equipment Bay		61
Crew Area		5
Heat Shield Equipment Area		37
Heat Shield Substructure		(1415)
Forward Section		195
Honeycomb Panels	109	1//
Frames and Rings	35	
Fittings and Mechanism	51	
Center Section	/-	694
Honeycomb Panels	246	3,-4
Frames and Rings	107	
Doors and Covers	185	
Fittings, Mechanism and Attachments	132	
Air Vent	24	
Aft Section		5 26
Honeycomb Panels	350	
Frames and Rings	47	
Fittings and Attachments	81	
Toroidal Assembly	48	
Ablation Material		(1273)
Forward Section		116
Center Section		529
Aft Section		628
Insulation		(195)
Separation Provisions and Attachments		(22)
LEM Docking		(150)

TOTAL STRUCTURE

4672



DETAIL WEIGHT STATEMENT

COMMAND MODULE

CREW SYSTEMS

ITEM	CURRENT WEIGHT 12-1-63
CREW SYSTEMS	
Crew Couch Support and Restraint System Waste Management Egress Accessories - Hatch Case Assembly - Map and Manual Structural Seats and Supports Shelf Assy Work/Food Preparation Food Storage Boxes	26.0 2.1 3.0 2.0 258.0 1.9 5.0
TOTAL CREW SYSTEMS	298.0



DONE IDENTIAL

DETAIL WEIGHT STATEMENT

COMMAND MODULE

COMMUNICATIONS

ITEM	CURRENT WEIGHT 12-1-63
COMMUNICATIONS	
Lower Bay C-Band Transponder Unified S-Band S-Band Power Amplifier VHF FM Transmitter/HF Transceiver VHF AM Trans Rec/VHF Rec. Bea. Multiplexer Spares Signal Conditioner Recorder Audio Center Premodulation Processor Central Timing Equipment Up Data Link and Provisions VHF-HF Diplexer VHF-UHF Diplexer Remote Equipment VHF-HF Recovery Antenna & Transmission C-Band Antenna & Transmission 2-KMC High Gain Antenna and Transmission VHF-2 KMC Omni Ant., Trans. & Instl. Prov. Electrical Provisions Electrical Wiring Data Distribution Panel Coax Connectors	(239.1) 20.8 25.0 20.5 15.9 14.0 11.0 19.0 32.8 25.4 8.0 25.0 1.7 .8 (57.9) 11.4 11.7 4.4 30.4 (86.0) 70.7 4.0 5.2 6.1
TOTAL COMMUNICATIONS	3 83 . 0



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DETAIL WEIGHT STATEMENT

COMMAND MODULE

INSTRUMENTATION

ITEM	CURRENT WEIGHT 12-1-63
INSTRUMENTATION	
Lower Equipment Bay PCM Unit No. 1 PCM Unit No. 2 Nuclear Radiation Detection Equipment	(58.0) 26.2 20.8 11.0
Remote Equipment Sensors Nuclear Radiation Detection Provisions TV Camera TV Viewfinder	(47.0) 35.0 6.0 4.5 1.5
Right Hand Bay Forward Inflight Test System Comparators and Power Supply Lamps Switches Meter Chassis Harness Access Cable	(36.1) 16.5 1.9 1.5 1.0 9.1 4.1 2.0
Electrical Provisions Inflight Test Electrical Provisions Data Distribution Panel	(33.9) 30.0 3.9
TOTAL INSTRUMENTATION	175.0



DETAIL WEIGHT STATEMENT CONMAND MODULE	GIID DIMI
CONTROLS AND DISPLAYS	CURRENT WEIGHT
I TEMOONEIDENTIAL	12-1-63
	•
MAIN DISPLAY PANEL	(***
Main Display Panel Control Station SCS Mode Select	(59.5)
Delta Velocity	3.2 2.3
Flight Director Attitude Indicator	10.0
Attitude Set and Gimbal Position Display	6.5
SPS Gimbal Actuator	.6
Entry Monitoring Indicator	15.0
Launch Vehicle Emergency Detection System C-1 Master Caution and Abort Lt.	4.7
IFTS Switch	.3 .1
Barometric Indicator Light	.1
Event Timer	1.5
Mounting Panels	2.2
Rendezvous Radar	13.0
Main Display Panel Center Station	(50.0)
Audio Panel	(59.2) 1.2
Abort Light	.2
Reaction Control	11.2
GMT Readout	.8
ECS Gages and Controls	7.2
Crew Safety Controls High Gain Antenna Control	1.6
G & N Computer Keyboard	2.6
Radiation Displays	15.0 3.0
Cryogenic	4.1
Caution and Warning Display	4.7
Mounting Panels	7.6
Main Display Panel System Management Station	(20.2)
Communications Control Panel	(30.3) 3. 9
Master Caution Lights	.2
Power Distribution	6.3
Fuel Cells Controls	4.6
Service Propulsion	8.4
IFTS Switch Cxygen Warning	.1
Mounting Panels	.1 6.7
	0.7
Main Display Panel RH Console	(10.4)
Bus Switches	5.7
Audio Panel	1.2
Lighting Control Mounting Panels	1.6
Touristing Takets	1.9
Main Display Panel LH Console	(7.9)
Mission Sequence Controls	1.0
Lighting Control	1.6
Audio Panel SCS Power Control	1:3
Mounting Panels	
TOTAL MAIN DISPLAY PANEL (To be brought forward)	167.3
20	(-)



DETAIL WEIGHT STATEMENT

COMMAND MODULE

CONTROLS AND DISPLAYS

ITEM	CURRENT WEIGHT 12-1-63	
REMOTE EQUIPMENT		
Lower Equipment Bay Lighting Control Panel G & N Controls and Displays Map and Data Viewer Display and Control - Navigation Display and Control - Computer	(51.4) 1.2 50.2 8.5 26.7 15.0	
Left Hand Forward Equipment Bay Clock Event Timer Mounting Panel	(2.6) .8 1.6 .2	
Crew Area Controls Manual Control - Rotation Manual Control - Translational	(22.5) 13.3 9.2	
Caution and Warning Detector Spares	(16.5) 14.0 2.5	
Electrical Provisions Electrical Wiring SCS/G & N Display Junction Box	(30.7) 29.0 1.7	
TOTAL REMOTE EQUIPMENT	123.7	
TOTAL MAIN DISPLAY PANEL	167.3	
TOTAL CONTROLS AND DISPLAYS	291.0	_





COMMAND MODULE

GUIDANCE & NAVIGATION

ITEM GUIDANCE AND NAVIGATION	CURRENT WEIGHT 12-1-63
Electronic Equipment Inertial Measurement Navigation Base Computer & Spare Tray Computer Stored Spares Power Servo Assembly Coupling Display Unit Junction Box Bellows Assembly	(280.7) 59.0 27.2 70.0 26.5 56.7 16.5 12.2 12.6
Optical Equipment Sextant Telescope Optical Base Optical Eyepieces	(45.8) 12.0 9.0 21.0 3.8
Loose Stored Items Film Cartridges (4) Computer Self Check Plug Computer Loose Spares Power Servo Assembly Loose Spares CDU Spare Gear Box Spare Relay & Diode Module Spare Lamps (3) Eye Relief Eyepiece Horizon Photometer	(41.5) 3.0 1.0 17.0 11.5 3.0 .3 .2 1.5 4.0
Electrical Provisions Cabling MIT Cabling NAA	(51.0) 35.0 16.0
Coolant Hoses	(1.0)
TOTAL GUIDANCE AND NAVIGATION	420.0



DETAIL WEIGHT STATEMENT

COMMAND MODULE

STABILIZATION AND CONTROL

ITEM	CURRENT WEIGHT 12-1-63
STABILIZATION AND CONTROL	
Lower Equipment Bay Rate Gyro Package Body Mounted Gyro Package Electronic Control Package - Pitch Electronic Control Package - Roll Electronic Control Package - Yaw Electronic Control Package - Auxiliary Display/BMAG ECA Package Spare Gyro - BMAG (2) Spare Gyro - Rate Spare Plug-in Module	(185.8) 7.5 12.8 29.1 28.4 28.2 28.4 36.9 2.0 .5 12.0
Electrical Provisions Wiring, etc. SCS Power Junction Box	(17.2) 15.7 1.5
TOTAL STABILIZATION AND CONTROL	203.0



DETAIL WEIGHT STATEMENT

COMMAND MODULE

REACTION CONTROL SYSTEM

ITEM		CURRENT WEIGHT 12-1-63
REACTION CONTROL SYSTEM		
Propellant System		(74.6)
Oxidizer System Tanks & Expulsion Devices Plumbing, Fittings & Insulation Valves & Regulators Sensors	15.0 11.4 10.3	37.2
Fuel System Tanks & Expulsion Devices Plumbing, Fittings & Insulation Valves & Regulators Sensors	15.2 11.4 10.3 .5	37.4
Pressure System Tanks (4500 psi) Plumbing, Fittings & Insulation Valves & Regulators Sensors		(55.4) 9.5 4.8 38.6 2.5
Engine System Engines Nozzle Extension		(141.6) 99.6 42.0
Electrical Provisions		(23.0)
Dumping System Valves & Supports Controls & Electrical Provisions Plumbing & Fittings Miscellaneous		(32.4) 13.0 12.0 5.0 2.4
TOTAL REACTION CONTROL SYSTEM		327.0



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DETAIL WEIGHT STATEMENT

COMMAND MODULE

ELECTRICAL POWER

ITEM	CURRENT WEIGHT 12-1-63
ELECTRICAL POWER	
Energy Source Battery - Re-entry (2) Battery - Post Landing (1) Battery - Pyrotechnic - Installation	(77.5) 45.0 22.5 10.0
Power Conversion Inverter (3) & Control Battery Charger & Controls PISS Battery Charging System	(123.0) 117.0 5.0 1.0
Power Distribution & Control D-C Power Panel Assy A-C Power Box Assy Battery Circuit Breaker Panel Lower Equipment Bay Panel Terminal Distribution Panel (Bus) Circuit Breaker Panel Electrical Transmission (Wiring, Connectors, Cond., Sup.) Ground Power Provisions Power Control Panel Connectors Installation Provisions	(95.3) 7.6 11.9 3.4 5.1 9.0 4.7 34.6 6.0 3.0 10.0
Electrical Common Utility Electrical Transmission (Wiring, Conn., Cond., & Sup.) Right Hand Circuit Breaker Panel Left Hand Circuit Breaker Panel Lighting Equipment Lighting Adapter Separation System LES Separation System S/M Pyrotechnic Initiation Circuit Utilization Package Sequencer Installation Provisions C/M to S/M Separation System Wiring & Hardware	(203.2) 87.7 16.0 10.5 10.3 5.0 5.0 3.5 3.0 6.6 39.1 13.5 3.0
TOTAL ELECTRICAL POWER	499.0



DETAIL WEIGHT STATEMENT

COMMAND MODULE

ENVIRONMENTAL CONTROL SYSTEM

ITEM:	CURPENT WEIGHT 12-1-63
ENVIRONMENTAL CONTROL SYSTEM	
Pressure Suit Circuit Subcontractor Compressor, Heat Exchg., Val. & Cont. Ducting, Conn., Clamps, etc. CO ₂ Sensor	(77.1) 68.6 6.5 2.0
Water-Glycol Circuit Subcontractor Res., Evaporator, Pump, Val. & Cont. Water-Glycol Plumbing, etc.	(59.3) 28.4 18.4 12.5
Pressure & Temp. Control Subcontractor Heat Exchg., Blower, Val. & Cont. Ducting	(19.0) 18.2 0.8
Oxygen Supply System Subcontractor Entry O2 Sys., Val. & Cont. Plumbing Oxygen Surge Tank	(16.0) 4.8 4.0 7.2
Water Supply System Subcontractor Potable & Waste Tanks & Freon Tank Plumbing Water Separator Accum. Warn. Sys.	(36.9) 23.2 11.7 2.0
Subcontractor Common Items Brackets, Plumbing, Elect. Wiring Instrumentation	(75.8) 11.5 14.3
Supports	(12.7)
Electrical Provisions	(01.0)
Manual Controls - Push Pull	(3.6)
N ₂ Purge System	(2.8)
Waste Management System TOTAL ENVIRONMENTAL CONTROL SYSTEM	(18.8) 293.0



COMMAND MODULE

EARTH LANDING SYSTEM

	CURRENT WEIGHT 12-1-63
EARTH LANDING SYSTEM	
Parachute System Drogue Chute System Main Cluster Disconnect Main Cluster Pilot Chute System Sequence Control Attach Provisions	(593.8) 68.4 439.2 3.1 28.5 12.2 42.4
Location Aids	(6.3)
Forward Heat Shield Release System	(47.9)
Drogue Disconnect Installation	(9.0)
Electrical Pyrotechnic Initiation Provisions	(6.0)
TOTAL EARTH LANDING SYSTEM	663.0



COMMAND MODULE

USEFUL LOAD

	OI ID DENIM
ITHM	CURRENT WEIGHT
	12-1-63
	2 ~ 2 0)
CREW SYSTEMS	
Government Furnished Equipment	(24, 2)
Pressure Garment Assembly (3)	(144.1)
Portable Life Support System (1)	79.2 42.1
Garments - Constant Wear	9.0
Biomedical Instrumentation	2.0
Personal Radiation Dosimeters	11.8
Crew (50, 70, 90 Percentile)	(528.0)
Food and Associated Equipment	(E3.5)
Food	(63.5) 67.5
Food Containers	12.5
Food Mouthpiece - Personal	2.0
Water Delivery Assembly - Personal	1.5
Crew Accessories	(8.0)
Lap Board Assembly	2.0
Manual Set	3.0
Map Set	1.0
Logbook Assembly	1.0
Tool Set - Inflight Maintenance	1.0
Crew Equipment	(26.2)
Shoe Straps	2.0
Hose Assembly - Umbilical	17.9
Belt Assembly - Inflight Maintenance	1.0
Hose Assembly - Recharging, Backpack	2.8
Suit Electrical Umbilical and Wire	2.5
Waste Management	(3.4)
Medical Equipment	(12.1)
Personal Hygiene Equipment	(15.6)
Light Assembly - Portable	(3.0)
Provision Assembly - Crew Survival	(42.1)
Personal Communications	
- 01 DOMAL COMMUNITOR OTOMS	(3.0)
TOTAL CREW SYSTEM (To be brought forward)	8 69 . 0
46	007.0



COMMAND MODULE

USEFUL LOAD

ITEM		CURRENT WEIGHT 12-1-63
REACTION CONTROL		(270.0)
Usable Propellant		225.0
Residual Propellant Trapped - System Mixture Ratio Expulsion Efficiency Loading Tolerance	30.8 2.7 7.8 2.7	44.0
RCS Helium		1.0
ENVIRONMENTAL CONTROL		(157.0)
Lithium Hydroxide Activated Charcoal Containers for LiOH & Charcoal Oxygen - Re-entry Water-Earth Orbit Cooling & Drinking Water-Boost Cooling Water-Emergency Re-Entry Cooling Water-PISS Initiated Charge Chemical Disinfectant		112.0 4.0 12.5 3.7 4.0 4.0 6.0 6.8 4.0
SCIENTIFIC EQUIFMENT		(250.0)
TCTAL This page		677.0
TOTAL CREW SYSTEM (Brought forward from Page 46)		869.0
TOTAL USEFUL LOAD		1546.0



DETAIL WEIGHT STATEMENT

SERVICE MODULE

SUMMARY

ITEM		CURRENT WEIGHT 12-1-63
WEIGHT EMPTY		7730
Structure	2290	
Electronics	351	
Reaction Control	580	
Electrical Power	1384	
Environmental Control	87	
Propulsion	3038	
USEFUL LOAD		22 3 0
Reaction Control	E3 8	
Electrical Power	503	
Environmental Control	20 8	
Propulsion	6 E 1	
BURNOUT WEIGHT		9960
MAIN PROPELLANT LOR		37 725
GROSS WEIGHT		40685





SERVICE MODULE

STRUCTURE

ITEM	CURPENT WEIGHT 12-1-63
STRUCTURE	
Basic Body Structure Honeycomb Panels Frame and Rings Access. Doors Fittings and Attach Parts Radial Beams Internal Partitions Forward Bulkhead Aft Bulkhead ECS Panels	(1616) 567 6 15 42 373 25 161 305 122
Secondary Structure Tank Support Shelf Engine Support Structure Antenna Support Structure Aft Heat Shield	(185) 29 54 50 52
Insulation	(299)
Separation Provisions and Attachments	(16)
Fairing - C/M to S/M	(144)
Miscellaneous	(30)
TOTAL STRUCTURE	2290



DETAIL WEIGHT STATEMENT

SERVICE MODULE

ELECTRONICS SUBSYSTEM

ITEM	CURRENT WEIGHT 12-1-63
ELECTRONICS SUBSYSTEM	
Communications High Gain Antenna	(51.0)
Antenna Gimbals Earth Sensor Antenna Boom Antenna Locking Provisions Coax Coax Coax Connectors Supports	12.2 12.0 4.8 7.0 3.0 8.0 1.0
Wiring	2.0
Instrumentation Sensors Electrical Provisions Supports	(130.0) 30.0 95.0 5.0
Rendezvous Equipment Radar Package VHF Antenna & Trans. & Supports X-Band Dish Ant., Trans. & Sup. Antenna Boom Antenna Actuation Mechanism Electrical Provisions Supports & Cooling Provisions	(91.6) 30.0 8.8 17.8 10.0 10.0 3.0 12.0
Transponder Transponder VHF Flush Mntd. Omni Ant. (3) VHF Power Divider VHF Trans. & Supports X-Band Flush Mntd. Omni Ant. (3) X-Band Trans. & Supports X-Pand Power Divider Electrical Provisions Supports & Cooling Provisions	(78.4) 10.0 30.0 1.0 12.8 3.0 12.6 1.0 3.0 5.0
TOTAL ELECTRONICS SUBSYSTEM	351.0



DETAIL WEIGHT STATEMENT

SERVICE MODULE

REACTION CONTROL

ITEM		CURRENT WEIGHT 12-1-63
REACTION CONTROL SYSTEM		
Propellant Systems Oxidizer System Tanks & Expulsion Devices Plumbing, Fittings & Insulation Valves & Regulators Sensors Supports Quantity Gaging	28.8 8.5 12.0 3.0 18.2 10.0	(161.4) 80.5
Fuel System Tanks & Expulsion Devices Plumbing, Fittings & Insulation Valves & Regulators Sensors Supports Quantity Gaging	29.2 8.5 12.0 3.0 18.2 10.0	80.9
Pressure System Tanks (4500 psi) Plumbing, Fittings & Insulation Valves & Regulators Sensors Supports		(128.0) 19.0 6.0 76.0 7.0 20.0
Engine System Engines Reflectors & Insulation		(150.4) 70.4 80.0
Structural Provisions		(80.0)
Electrical Provisions		(60.2)
TOTAL REACTION CONTROL SYSTEM		580.0



DETAIL WEIGHT STATEMENT

SERVICE MODULE

ELECTRICAL POWER

ITEM	CURRENT WEIGHT 12-1-63
ELECTRICAL POWER	
Fuel Cell Power System Fuel Cell Power Pack (Incl. Mount Instrumentation) Intermodular - Radiator Plumbing Fuel Cell Module Mount Attach Fuel Cell H2 System	(1196.6) 753.6 26.7 2.0
Subcontractor Components Plumbing and Valves Fuel Cell and ECS O2 System	153.2 5.5
Subcontractor Components Plumbing and Valves and Supports Water Glycol - Fuel Cell Heat Transfer System Elect. Wiring - Supercritical Gas Space Radiator (Cuter Skin) Fuel Cell Module Stabilization Webs Fuel Cell Plumbing Supports	168.2 31.7 7.0 10.0 26.9 3.8 8.0
Power Distribution Electrical Transmission Power Distribution Box	(71.2) 40.0 31.2
Electrical Common Utility Electrical Transmission Sequencer Adapter Separation System C/M to S/M Separation System Pyrotechnic Initiation Provisions	(116.2) 41.0 28.0 7.0 18.0 12.0 10.2
TOTAL ELECTRICAL POWER	1384.0





SERVICE MODULE

ENVIRONMENTAL CONTROL SYSTEM

ITEM	CURRENT WEIGHT 12-1-63
ENVIRONMENTAL CONTROL SYSTEM	
Water-Glycol Circuit Subcontractor Valves & Controls Plumbing and Hardware Water - Glycol Space Radiator (Cuter Skin)	(74.8) 6.0 21.5 10.0 37.3
Water Supply System Plumbing and Hardware Miscellaneous Brackets & Supports	(7.5) 7.0 .5
Cxygen Supply System Plumbing and Supports	(3.0 ⁾ 3.0
Common Items Supports	(1.7) 1.7
TOTAL ENVIRONMENTAL CONTROL SYSTEM	87.0



DETAIL WEIGHT STATEMENT

SERVICE MODULE

MAIN PROPULSION

ITEM		CURRENT WEIGHT 12-1-63
MAIN PROPULSION		
Propellant Systems Oxidizer System Tanks & Doors Skirts Plumbing, Fittings & Insulation Valves Quantity Indication Mixture Ratio Control Supports - Plumbing & Equipment	557.0 59.8 53.0 4.5 25.5 14.0 45.5	(1356.0) 759.3
Fuel System Tanks & Doors Skirts Plumbing, Fittings & Insulation Valves Quantity Indication Supports - Plumbing & Equipment	458.0 33.2 42.0 4.5 25.5 33.5	596.7
Pressure System Tanks (4400 psi) Tank Supports Plumbing, Fittings & Insulation Valves, Regulators & Heat Exchanger Supports - Plumbing & Equipment		(925.0) 784.0 30.0 24.0 49.0 3 8.0
Engine System Engine Closeouts - Throat to S/M Electrical Provisions		(715.0) 690.0 25.0 (42.0)
TOTAL MAIN PROPULSION SYSTEM		3038.0



DETAIL WEIGHT STATFMENT

SERVICE MODULE

USEFUL LOAD

ITEM		CURRENT WEIGHT 12-1-63
REACTION CONTROL		(838.0)
RCS Propellant Usable Residual Trapped System 4.0 Nixture Ratio 9.0 Expulsion Efficiency 24.0	790.0 45.0	835.0
Loading Tolerance 8.0 RCS Helium		3.0
ELECTRICAL POWER (Normal Mission)		(503.0)
Hydrogen - Supercritical Gas Usable (Electrochemical Incl. Tolerance) Unusable (Residual & Instrument Error) Emergency Provisions	46.0 3.2 4.7 4.6	58.5
Expended (Leakage & Purge) Oxygen - Supercritical Gas Usable (Electrochemical Incl. Tolerance) Unusable (Eesidual & Instrument Error) Emergency Provisions Expended (Leakage & Purge)	377.0 17.5 44.0 6.0	444.5
ENVIRONMENTAL CONTROL (Normal Mission) Oxygen - Supercritical Gas Usable (Metabolic) Unusable (Residual & Instrument Error) Emergency Provisions Expended (Leakage, LEM, PISS, Repress.)	76.5 9.1 25.3 97.1	(208.0) 208.0
PROPULSION Main Propulsion Helium Main Propellant Residuals		(681.0) 99.0 582.0
Trapped - System Trapped - Engine Mixture Ratio Tolerance Loading Tolerance	225.0 67.0 100.0 190.0	
TOTAL USEFUL LOAD (Less Main Propellant)		2230.0





LAUNCH ESCAPE SYSTEM

SUMMARY

ITEM	CURRENT WEIGHT 12-1-63
LAUNCH ESCAPE SYSTEM	
Structure	(1065)
Tower Assy Escape Motor Skirt Pitch Motor Structure Nose Cone and Ballast Support Attaching Parts Tower Insulation Skirt Insulation	345 209 162 114 9 216 10
Separation Provision	(67)
Ballast	(505)
Propulsion	(5345)
Escape Motor Jettison Motor Jettison Motor Skirt Pitch Control Motor	4764 434 92 55
Electrical Power	(58)
C/M Boost Protection Cover	(175)
TOTAL LAUNCH ESCAPE SYSTEM	7215



- TOWN DELET

DETAIL WEIGHT STATEMENT

ADAPTER

SUMMARY

ITEM	CURRENT WEIGHT 12-1-63
ADAPTER	
Structure Panels Frames Thermal Insulation	(3070) 2470 200 400
Electrical Power	(03)
Separation System	(250)
TOTAL ADAPTER	3400